REMARKS

Careful consideration has been given by the applicant to the Examiner's comments and rejection of the claims as set forth in the outstanding Office Action, and favorable reconsideration and allowance of the application, as amended, is earnestly solicited.

Applicant notes the Examiner's rejection of claims 20-25 under 35 U.S.C. §102(b), as being anticipated by Wagenseil, U.S. Patent No. 5,007,332, that particular patent being commonly assigned to the present assignee, and for the reasons of rejection as detailed in the Office Action.

Furthermore, applicant notes the rejection of claims 16-19 as being unpatentable under 35 U.S.C. §103(a) over the admitted prior art in view of Miller, et al. U.S. Patent No. 5,591,293 as detailed in the Office Action; the rejection of claim 18 as being unpatentable similar to claim 16 and further in view of Wagenseil; the rejection of claims 26 and 27 as being unpatentable over Wagenseil, as detailed in the Office Action; and the rejection of claims 28 and 29 as being unpatentable over Wagenseil and further in view of Wiethoff U.S. Patent No. 3,828,654, as also extensively detailed in the Office Action.

Accordingly, in order to clearly and unambiguously distinguish over the art, irrespective as to whether the latter is considered singly or in combination, applicant respectfully submits the following arguments in traverse of the rejection.

Prior to discussing the art cited by the Examiner, applicant refers to the publications representing the admitted prior art, as also set forth in the specification and as submitted in the Information Disclosure Statement, filed January 11, 2002, as follows:

EP 0 371 834 A1 describes a method and an apparatus for producing a ball-and-socket joint between a slipper and a piston of an axial piston machine. In this prior art publication, the

recess edge is electro-magnetically formed-in (Fig. 2), particularly, at a specific temperature difference of 100°C, which is present between the joint ball and the slipper in order to obtain a reduced joint play after the mounted ball-and-socket joint has cooled down. In this respect, the following is set forth in column 4, lines 43-55; as paraphrased hereinbelow:

The magnetically effective pressing device of EP 0 371 834 A1 operates as follows:

> "As the spherical ball 3 is generally formed of a suitable steel (for example, annealed steel 100 C6), the temperature of said ball 3 may never reach 100°C, not even at the surface. The oven 11 is thus adjusted such that at the moment the pressing takes place, after the heated piston 5 has been supplied through the tube 12, the temperature difference between the shoe 2 and the ball 3 is about 100°C, depending on the desired play."

The description set forth hereinabove renders it clear that in this prior art publication it is neither a local heating of the recess edge to a temperature reducing its hardness nor a heat beading which is important, but rather, to the contrary, a slight degree of heating to only obtain a specific joint play.

The subject matter of DE 197 34 217 A1, which corresponds to U.S. Patent No. 5,724,733, is discussed in detail on page 1 of the present patent application to which applicant refers hereinbelow.

WO 98/42949A describes a method for producing a ball-and-socket joint of a piston machine. In this method, in order to insert the joint ball into the joint recess, the joint recess is transversely expanded by a pressure means (Fig. 1B and Fig. 3) or the piston head is expanded after insertion into the joint recess (see Figs. 4-6).

A beading of the free recess edge into a form which grips behind the joint ball is only of general importance in this prior art patent. Therefore, as merely stated in the first paragraph on page 6 of this publication is that the recess edge is plastically deformable.

DE 198 02 475 A1 describes that the recess edge is annealed by supplying of heat and, at the same time, deformed by means of a forming tool against a joint ball and/or a groove formed therein, referring to column 4, lines 10-14 and column 6, lines 50-55 of the patent. However, this foreign publication was not published until after the present priority date of July 21, 1999 and is thus not applicable to the claimed invention.

Concerning the foregoing, the present application and the claims were clearly drafted in order to patentably distinguish over the particular prior art publications as submitted by the applicant in the Information Disclosure Statement.

Reverting now, in particularity, to the prior art publications cited by the Examiner in the Office Action, applicant submits as follows:

U.S. Patent No. 5,007,332, as cited by the Examiner in the Office Action, shows a ball-and-socket joint for an axial piston machine, wherein the slipper has a joint recess in which a joint ball of a piston is supported, the recess edge of the joint recess gripping behind the joint ball. A slipper consists in a usual design of bronze, the recess edge being usually cold-beaded.

A ball-and-socket joint similar to that described above is described in U.S. Patent No. 3,828,654.

U.S. Patent No. 5,360,840 relates to plastic materials with an improved storage stability and must thus be considered a prior art which is even further remote from the present invention.

U.S. Patent No. 5,591,293 describes a method and an apparatus for producing irrigating installations of plastic hoses, the hoses being provided with drip outlets successively disposed in longitudinal direction. This art is likewise prior art which is further remote from the present invention.

Concerning the foregoing, applicant notes that German DE 197 34 217, which corresponds to U.S. Patent No. 5,724,733 and U.S. Patents 6,318,241 B1 and 5,007,332 apparently constitute the most relevant prior art.

Concerning the foregoing, applicant also submits the following arguments in traverse of the rejection, and in support of the amended claims:

Inasmuch as independent claims 16 and 17 are reverse configurations as regards the features "joint ball (4)" and "joint recess (5)", applicant has submitted claims 16 and 17 as is evident from the enclosed amended claims.

As regards the independent claims 20 and 23, applicant has provided a feature as "reducing the hardness of the point recess", replacing the current feature "changing the material properties" as not being adequately defining.

Moreover, also incorporated into these claims is the feature that the recess edge (7) not only has a convergent form as a whole, but that the outer surface of the recess edge (7) also has a convergent form in respect of the inner surface, as it is evident from Figs. 1 and 2 and as it is described at the beginning of the fourth paragraph of page 3 of the specification. This conicity further patentably distinguishes claims 20 and 23 from all of the three above-mentioned prior art publications.

Moreover, applicant has incorporated claims 21 and 22 as features into amended claim 20, and claims 24 and 25 as features into amended claim 23, respectively.

Applicant disagrees with the position taken by the Examiner in paragraph 4 of the Office Action that claims 16 to 19 are anticipated by the prior art according to U.S. Patent No. 5,591,293 (Miller, et al.). None of the features of claim 16 or 17, nor feature claim 16. f) or claim 17. f) are inferable from this document. The feature "sealing" of U.S. Patent No.

5,591,293 does not have anything to do with the "beading" according to the invention and, in particular, not with the "hot-beading" according to the invention, after a reduction of the hardness of the material.

Applicant also respectfully disagrees with the Examiner's opinion stated in the Office Action in paragraph 2 that claims 20-25 are anticipated by U.S. Patent No. 5,007,332 (Wagenseil). In this commonly owned prior art, the slipper is made of bronze. Therefore, the features in claim 16 and 17 and the feature "hot-beading" are not required and are not implemented. As neither the slipper 18 nor the flange 31 are hot-beaded, the problems underlying the present invention are not inferable from this document and, therefore, this known configuration is not deemed to render the configurations of the invention according to claims 20 and 23 obvious to one of skill in the art.

The inventions contained in claims 16 and 17, 20 and 23, respectively, are based on an inventive step for the following reasons:

The invention starts out from a particular problem which is best represented by the prior art according to the foregoing, wherein the piston (2) with an oversized dimension (x) is prefabricated, hardened and subsequently ground.

The problem underlying the invention is clearly reflected by claim 1 of the foregoing patent in which the individual process steps of the known method are described namely, inserting the spherical ball of the slipper into the cavity..., forcing the contoured portion of the connecting portion inwardly..., hardening the outer surface of the piston... and finishing the outer surface of the piston...

In this prior art patent, not only the ball-and-socket join is contaminated by chips caused when the piston is machined by grinding, but also the cold-beading of the material is problematic in nature.

The invention is thus based on the object set forth in the third paragraph of page 1 of the description. The object is solved by the features contained in claims 16, 17, 20 and 23, respectively.

In the invention according to claims 16 and 17, it is essential that the "grinding of the piston to its final dimension" is effected before the joint is assembled and, therefore, the joint is not contaminated by chips.

This is achieved in that the insertion of the joint ball..., the local reduction of the hardness of the material of the recess edge (7)... and the hot-beading of the free recess edge (7)...are effected after the machining (finishing) of the periphery of the piston.

Moreover, the ball-and-socket joint is improved because the recess edge is formed by "hot-beading". This does not only improve the adaptation of the contour of the recess edge to the ball shape, but also stresses in the material are reduced and a reduced spring back is achieved. This specific result due to the manufacturing steps cannot be rendered obvious by the prior art, in view of which these claims are based on an inventive step.

Product claims 10 and 21, which do not express that the features "finishing..." and "inserting..." are preformed successively in time because they are product claims, are also based on an inventive step for the following reasons:

First of all, it is essential that "hot-beading" results into an improved shaping as compared to "cold-beading". By "hot-beading", the recess edge can be better adapted to the ball shape of the joint ball, these advantages being associated with a hot-beading both of the recess

edge of the slipper (claim 23) and the recess edge of the piston (claim 20). As the relevant cited documents do not describe a "hot-beading", claims 20 and 23 are based on an inventive step.

Moreover, in claim 20, during hot-beading, the hardness of the recess edge of the piston as previously produced is reduced, which is the prerequisite for a deformation which is to be implemented.

In "hot-beading", the process steps "reducing of the hardness" and "hot-beading" are simultaneously performed.

As both "hot-beading" and "reducing in hardness" are not inferable or suggested from the relevant prior art, claim 20 (hot-beading of the recess edge of the piston) should be patentable.

Furthermore, the present invention has achieved significant commercial success and importance inasmuch as the ball and socket joints according to the disclosure and claims are sold worldwide. Consequently, in order to derive allowance for the application, in the event that the Examiner has any queries, applicant's attorney respectfully requests that he be accorded the courtesy of a telephone conference to discuss any matters and the patentability of the present claims.

Finally, as requested in the previous Office Action, applicant encloses a revised Declaration and Power of Attorney in compliance with 37 C.F.R. §1.67(a), thereby meeting the formal requirements of the Examiner.

Respectfully submitted,

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